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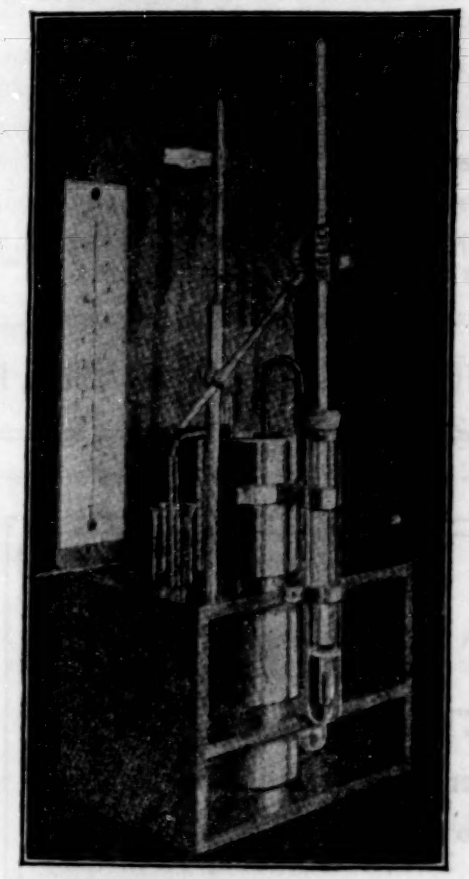

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SCIENCE

VOL. LVIII SEPTEMBER 28, 1923 No. 1500

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SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

New York City: Grand Central Terminal.

Annual Subscription, $6.00. Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 3, 1879.

MODERN ZOOLOGY[1]

ZOOLOGY has far outgrown its early boundaries when it could be defined simply as a part of natural history, and at no period has its growth been more rapid or more productive in results of scientific and practical importance than in the interval since our last meeting in this city. It is, however, impossible, even if time permitted, for any one observer to survey the many lines of activity in zoology or to record its contributions to knowledge in this fruitful period. I have thought it might be profitable to endeavor to take in retrospective glance the broad outlines of development of zoology during the last two or three decades, and then to limit our further consideration more especially to some of the relations of zoology to human welfare. The period under review has witnessed a growth of our knowledge of the living organism of the same order of importance as the progress in our knowledge of the atom. Never have investigators probed so deeply or with so much insight into the fundamental problems of the living animal; the means for observation and recording have become more delicate, and technique of all kinds more perfect, so that we can perceive details of structure and follow manifestations of activity of the organism which escaped our predecessors.

At the time of the last Liverpool meeting and for some few years previously, a distrust of the morphological method as applied to the study of evolution had been expressed by a number of zoologists. At that meeting Professor MacBride put forward an able defense of morphology while recognizing that the morphological method had its limitations, which must be observed if the conclusions are to rest on safe ground. Through undue zeal of some of its devotees morphology had been pushed too far on arid and unproductive lines, and rash speculation based on unsound morphology brought discredit on this branch of our science. It is now fully recognized that the observed resemblances between animals are due, some of them to genetic relationships, and others to convergent evolution, and therefore that the conclusions drawn from the study of morphology are to be interpreted with the greatest circumspection. There are some groups of animals, *e.g.*, the earthworms, in regard to the evolutionary history of which we can

[1] From the address of the president of the Section of Zoology of the British Association for the Advancement of Science, Liverpool, September, 1923.

never hope to receive help from paleontology; we must perforce make the best use we can of the morphological method applied, be it understood, with wide knowledge and deep insight. That careful systematic work, coupled with the skilful application of sound morphological principles, is capable of yielding results of specific and general importance is well illustrated by the researches of Michaelsen and of Stephenson on Indian Oligochetes; these authors have been able to trace the lines of evolution of the members of the family Megascolecidae so completely that we know their history as well as we know that of the Equidae. Again, to take an example from a different category, the fine morphological work on the cell and on the nucleus and its chromosomes which we owe to Hertwig, Flemming, Boveri, van Beneden, Wilson and others, made possible the modern researches and conceptions in regard to inheritance and sex. The danger that morphology will be pushed to excess is long past; the peril seems to me to be rather in the opposite direction, *i.e.*, that some of our students before passing on to research receive too little of that training and discipline in exact morphology by which alone they can be brought to appreciate how the components of the living organism are related to one another and to those of allied species or genera, and how they afford, with proper handling, many data for the evolutionist. I plead, therefore, for the retention of a sound and adequate basis of morphology in our zoological courses.

No one who engages in the study of morphological problems can proceed far without meeting questions which stimulate inquiry of a physiological nature, and, where means are available, resort to experimental procedure is the natural mode of arriving at the answer. That morphology is detrimental to or excludes experimental or physiological methods is entirely contrary to present day experience, and indeed the fruitfulness of the combination of morphology and physiology could have been amply illustrated any time during the last eighty years simply by reference to the work of Johannes Müller. The structure of an organism must be known before its coordinated movements can be adequately appreciated—morphology must be the forerunner of physiology.

Another of the basal supports of our science an appreciation of which, or better still a training in some branch of which, we must encourage is the systematic or taxonomic aspect. The student or graduate who is proceeding to specialize in experimental zoology or in genetics particularly requires a sound appreciation of the fact that the accurate determination of the genus and species under investigation is a primary requisite for all critical work—it is part of the fundamental data of the experiment and is essential, if for nothing else, to permit subsequent observers to repeat and perhaps to extend any given series of observations. Moreover, the systematic position of an animal is an expression of the final summary of its morphology and its genetic relationships, and it is from such summaries that we have to attempt in many cases—as, for example, in the Oligochetes already cited—to discover in a restricted group or order the probable course of evolution, though the method of evolution may not be ascertainable. From these summaries prepared by systematists issue problems for the experimental evolutionist and the geneticist. As Mr. Bateson has pointed out, it is from the systematist who has never lost the longing for the truth about evolution that the raw materials for genetical researches are to be drawn, and the separation of the laboratory men from the systematists imperils the work and the outlook of both.

Among the notable features of zoological activity during the last twenty-five years the amount of work on the physiology of organisms other than mammals must attract early notice in any general survey of the period. Eighty years ago Johannes Müller's physiological work was largely from the comparative standpoint, but for some years after his death the comparative method fell into disuse, and the science of physiology was concerned chiefly with the mode of action of the organs of man or of animals closely related to man, the results of which have been of outstanding importance from their bearing on medicine. Interest in the more general applications of physiology was revived by Claude Bernard ("Leçons sur les phénomènes de la vie," 1878), and the appearance of Max Verworn's "General Physiology," in 1894, was in no inconsiderable measure responsible for the rapid extension of physiological methods of inquiry to the lower organisms—a development which has led to advances of fundamental importance. Many marine and freshwater organisms lend themselves more readily than the higher vertebrates to experimentation on the effects of alterations in the surrounding medium, on changes in metabolic activity, on the problems of fertilization and early development, on the chemistry of growth and decline, and to the direct observation of the functioning of the individual organs and of the effects thereon of different kinds of stimuli. The study of these phenomena has greatly modified our interpretation of the responses of animals and has given a new impetus to the investigation of the biology and habits of animals, *i.e.*, animal behavior. This line of work—represented in the past by notable contributions such as those by Darwin on earthworms, and by Lubbock on ants, bees and wasps—has assumed during the last two or three decades a more intensive form, and has afforded a more adequate idea of the living organism as a working entity, and revealed the delicacy of balance which exists between structure,

activity and environment. This closer correlation of form, function and reaction is of the greatest value to the teacher of zoology, enabling him to emphasize in his teaching that for the adequate appreciation of animal structure a clear insight into the activities of the organism as a living thing is essential.

The penetrating light of modern investigation is being directed into the organism from its earliest stage. During the summer of 1897 Morgan discovered that the eggs of sea-urchins when placed in a two per cent. solution of sodium chloride in sea-water and then transferred to ordinary sea-water would undergo cleavage and give rise to larvae, and J. Loeb's investigations in this field are familiar to all students of zoology. Artificial parthenogenesis is not restricted to the eggs of invertebrates, for Loeb and others have shown that the eggs of frogs may be made to develop by pricking them with a needle, and from such eggs frogs have been reared until they were fourteen months old. The application of the methods of microdissection to the eggs of sea-urchins is leading to a fuller knowledge of the constitution of the egg, of the method of penetration of the sperm, and of the nuclear and cytoplasmic phenomena accompanying maturation and fertilization, and will no doubt be pursued with the object of arriving at a still closer analysis of the details of fertilization.

The desire for more minute examination of developing embryos led to the more careful study of the egg-cleavage, so that in cases suitable for this method of investigation each blastomere and its products were followed throughout development, and thus the individual share of the blastomere in the cellular genesis of the various parts of the body was traced. This method had been introduced by Whitman in his thesis on Clepsine (1878), but it was not until after the classical papers of Boveri on Ascaris (1892) and E. B. Wilson on Nereis (1892) that it came into extensive use. About the time of our last meeting here, and for the next twelve or fifteen years, elaborate studies on cell-lineage formed a feature of zoological literature and afforded precise evidence on the mode of origin of the organs and tissues, especially of worms, molluscs and ascidians. A further result of the intensive study of egg-cleavage has been to bring into prominence the distinction between soma-cells and germ-cells, which in some animals is recognizable at a very early stage, *e.g.*, in Miastor at the eight-cell stage. The evidence from this and other animals exhibiting early segregation of germ-cells supports the view that there is a germ-path and a continuity of germ-cells, but the advocates of this view are constrained to admit there are many cases in which up to the present an indication of the early differentiation of the germ-cells has not been forthcoming on investigation, and that the principle can not be held to be generally established.

A cognate line of progress which, during the period under review, has issued from the intensive study of the egg and its development is experimental embryology—devoted to the experimental investigation of the physical and chemical conditions which underlie the transformation of the egg into embryo and adult. By altering first one and then another condition our knowledge of development has been greatly extended, by artificial separation of the blastomeres the power of adjustment and regulation during development has been investigated, and by further exploration of the nature of the egg the presence of substances foreshadowing the relative proportions and positions of future organs has been revealed in certain cases, the most striking of which is the egg of the Ascidian *Cynthia partita* (Conklin, 1905). Still further intensive study of the cytoplasm and nuclei of eggs and cleavage stages is required to throw light on the many problems which remain unsolved in this domain.

Progress in investigation of the egg has been paralleled by increase in our knowledge of the germ-cells, especially during their maturation into eggs and sperms, the utmost refinements of technique and observation having been brought to bear on these and on other cells. During the last thirty years, and especially during the latter half of this period, cytology has developed so rapidly that it has become one of the most important branches of modern biology. One of the landmarks in its progress was the appearance, at the end of 1896, of E. B. Wilson's book on "The Cell," and we look forward with great expectations to the new edition which, it is understood, is in an advanced stage of preparation. A great stimulus to cytological work resulted from the rediscovery in 1900 of the principle of heredity published by Mendel in 1865, which showed that a relatively simple conception was sufficient to explain the method of inheritance in the examples chosen for his experiments, for in 1902 Sutton pointed out that an application of the facts then known as to the behavior of the chromosomes would provide an explanation of the observed facts of Mendelian inheritance. In the same year McClung suggested that the accessory chromosome in the male germ-cells is a sex-determinant. These two papers may be taken as the starting point of that vast series of researches which have gone far toward the elucidation of two of the great problems of biology—the structural basis of heredity and the nuclear mechanism correlated with sex. The evidence put forward by Morgan and his colleagues, resulting from their work on Drosophila, would seem to permit little possibility of doubt that factors or genes are carried in the chromosomes of the gametes, and that the behavior of the chromosomes during maturation of the germ-cells and in fertilization offers a valid explanation of the mode of inheritance of characters. The solution of this great riddle of biology has been

arrived at through persistent observation and experiment and by critical analysis of the results from the point of view of the morphologist, the systematist, the cytologist, and the geneticist.

Among other important developments in the period reference may be made to the great activity in investigation of the finer structure of the nerve-cell and its processes. By 1891 the general anatomical relations of nerve-cells and nerve-fibers had been cleared up largely through the brilliant work of Golgi and Cajal on the brain and spinal cord, and of von Lenhossék, Retzius, and others on the nervous system of annelids and other invertebrates. In these latter had been recognized the receptor cells, the motor or effector cells, and intermediary or internunciary cells interpolated between the receptors and effectors. In June, 1891, Waldeyer put forward the neurone theory, the essence of which is that the nerve-cells are independent and that the processes of one cell, though coming into contiguous relation and interlacing with those of another cell, do not pass over into continuity. He founded his views partly upon evidence from embryological researches by His,but chiefly on results obtained from Golgi preparations and from anatomical investigations by Cajal. The neurone theory aroused sharp controversy, and this stimulus turned many acute observers—zoologists and histologists—to the intimate study of the nerve-cell. First among the able opponents of the theory was Apáthy, whose well-known paper, published in 1897, on the conducting element of the nervous system and its topographical relations to the cells, first made known to us the presence of the neurofibrillar network in the body of the nerve-cell and the neurofibrils in the cell-processes. Apáthy held that the neurofibrillar system formed a continuous network in the central nervous system, and he propounded a new theory of the constitution of the latter, and was supported in his opposition to the neurone theory by Bethe, Nissl and others. The controversy swung to and fro for some years, but the neurone theory—with certain modifications—seems now to have established itself as a working doctrine. The theory first enunciated as the result of morphological studies receives support from the experimental proof of a slight arrest of the nerve-impulse at the synapse between the two neurones, which causes a measurable delay in the transmission. The latest development in morphological work on nerve-elements is the investigation of the neuromotor system in the Protozoa. Sharp (1914), Yocom (1918), and Taylor (1920), working in Kofoid's laboratory, have examined this mechanism in the ciliates Diplodinium and Euplotes and they describe and figure a mass—the neuromotorium—from which fibrils pass to the motor organs, to the sensory lip, and, in Diplodinium, to a ring round the oesophagus. The function of the apparatus is apparently not supporting or contractile, but conducting. By the application of the finest methods of micro-dissection specimens of Euplotes have been operated upon while they were observed under an oil-immersion objective. Severance of the fibres destroyed coordination between the membranelles and the cirri, but other incisions of similar extent made without injuring the fibrillar apparatus did not impair coordination, and experiments on Paramaecium by Rees (1922) have yielded similar results. While the experimental evidence is as yet less conclusive than the morphological, it supports the latter in the view that the fibrils have a conducting, coordinating function. Progress in our knowledge of the nervous system is but one of many lines of advance in our understanding of the correlation and regulation of the component parts of the animal organism.

The ciliate protozoa have been the subject during the last twenty years of a series of investigations of great interest, conducted with the purpose of ascertaining whether decline and death depend on inherent factors or on external conditions. While these researches have been in progress we have come to realize more fully that ciliates are by no means simple cells, and that some of them are organisms of highly complex structure. Twenty years ago Calkins succeeded in maintaining a strain of Paramaecium for twenty-three months, during which there were 742 successive divisions or generations, but the strain, which had exhibited signs of depression at intervals of about three months, finally died out, apparently from exhaustion. From this work, and the previous work of Maupas and Hertwig, the opinion became general that ciliates are able to pass through only a limited number of divisions, after which the animals weaken, become abnormal and die, and it was believed that the only way by which death could be averted was by a process of mating or conjugation involving an interchange of nuclear material between the two conjugants and resulting in a complete reorganization of the nuclear apparatus. Jennings has shown that conjugation is not necessarily beneficial, that the ex-conjugants vary greatly in vitality and reproductive power, and that in most cases the division rate is less than before conjugation. Woodruff has since May 1, 1907, kept under constant conditions in culture a race of Paramaecium. During the sixteen years there have been some ten thousand generations, and there seems no likelihood of or reason for the death of the race so long as proper conditions are maintained. The possibility of conjugation has been precluded by isolation of the products of division in the main line of the culture, and the conclusion is justifiable that conjugation is not necessary for the continued life of the organism. The criticism that Woodruff's stock

might be a non-conjugating race was met by placing the Paramaecia, left over from the direct line of culture, under other conditions when conjugation was found to occur. Later observations by Erdmann and Woodruff show that a reorganization of the nuclear apparatus of Paramaecium takes place about every twenty-five to thirty days (forty to fifty generations). This process, termed endomixis (in contrast to amphimixis), seems to be a normal event in the several races of Paramaecium which Erdmann and Woodruff have examined, and it is proved to coincide with the low points or depressions in the rhythm exhibited by Paramaecium. The occurrence of endomixis raises the question, to which at present there is no answer, as to whether this process is necessary for the continued health of the nuclear apparatus and of the cytoplasm of Paramaecium.

Enriques (1916) maintained a ciliate—*Glaucoma pyriformis*—through 2,701 generations without conjugation, and almost certainly without endomixis. From a single "wild" specimen he raised a large number and found that conjugating pairs were abundant, so that the objection could not be made that this was a non-conjugating race. Enriques then began his culture with one individual, and examined the descendants morning and evening, removing each time a specimen for the succeeding culture. The number of divisions per day varied from nine to thirteen, and as there was no break in the regularity and rapidity of division, and no sort of depression, Enriques concluded that neither endomixis nor conjugation could have occurred, for these processes take some time and would have considerably reduced the rate of division. These results, especially if they are confirmed by cytological study of preserved examples, show that for Glaucoma neither conjugation nor endomixis is necessary for continued healthy existence. Hartmann's observations (1917) on the flagellate *Eudorina elegans* extend the conclusion to another class of Protozoa. He followed this flagellate through 550 generations in two and a half years. The mode of reproduction was purely asexual, and there was no depression and no nuclear reorganization other than that following fission. The evidence seems sufficient to confirm the view that certain Protozoa, if kept under favorable conditions, can maintain their vigor and divide indefinitely, without either amphimixis or endomixis.

Child (1915) states as the result of his experiments that the rate of metabolism is highest in Paramaecium and other ciliates immediately after fission—"in other words, after fission the animals are physiologically younger than before fission." This view, that rejuvenescence occurs with each fission, derives support from the observations of Enriques and Hartmann, for no other process was found to be taking place and yet the vigor of their organisms in culture was unimpaired. If, then, fission is sufficiently frequent—that is, if the conditions for growth remain favorable—the protoplasm maintains its vigor. If through changes in the external conditions the division rate falls, the rejuvenescence at each fission may not be sufficient to balance the deterioration taking place between the less frequent divisions. Under such conditions endomixis or conjugation may occur with beneficial results in some cases, but if these processes are precluded there is apparently nothing to arrest the progressive decline or "ageing" observed by Maupas and others. But further investigations are required on the physiology and morphology of decline in the protozoan individual.

The culture of tissues outside the body is throwing new light on the conditions requisite for the multiplication and differentiation of cells. R. G. Harrison (1907) was the first to devise a successful method by which the growth of somatic cells in culture could be followed under the microscope, and he was able to demonstrate the outgrowth of nerve-fibers from the central nervous tissue of the frog. Burrows (1911), after modifying the technique, cultivated nervous tissue, heart-cells, and mesenchymatous tissue of the chick in blood-plasma and embryonic extract, and this method has become a well-established means of investigation of cell-growth, tissues from the dog, cat, rat, guinea-pig, and man having been successfully grown. One strain of connective tissue-cells (fibroblasts) from the chick has been maintained in culture in vigorous condition for more than ten years, that is for probably some years longer than would have been the normal length of life of the cells in the fowl. Heart-cells may be grown generation after generation—all traces of the original fragment of tissue having disappeared—the cells forming a thin, rapidly growing, pulsating sheet. Drew (1922) has recently used instead of coagulated plasma a fluid medium containing calcium salts in a colloidal condition, and has obtained successful growth of various tissues from the mouse. He finds that epithelial cells when growing alone remain undifferentiated, but on the addition of connective tissue differentiation soon sets in, squamous epithelium producing keratin, mammary epithelium giving rise to acinous branching structures, and when heart-cells grow in proximity to connective tissue they exhibit typical myofibrillae, but if the heart-cells grow apart from the connective tissue they form spindle-shaped cells without myofibrillae. This study of the conditions which determine the growth and differentiation of cells is only at the beginning, but it is evident that a new line of investigation of great promise has been opened up which should lead also to a knowledge of the factors which determine slowing down of the division-rate and the cessation of division, and finally the complete decline of the cell.

For many lines of work in modern zoology bio-

chemical methods are obviously essential, and the applications of physics to biology are likewise highly important—*e.g.*, in studies of the form and development of organisms and of skeletal structures. Without entering into the vexed question as to whether all responses to stimuli are capable of explanation in terms of chemistry and physics, it is very evident that modern developments have led to the increasing application of chemical and physical methods to biological investigation, and consequently to a closer union between biology, chemistry and physics. It is clear also that the association of zoology with medicine is in more than one respect becoming progressively closer—comparative anatomy and embryology, cytology, neurology, genetics, entomology and parasitology, all have their bearing on human welfare.

J. H. ASHWORTH

BIOLOGICAL ABSTRACTS

ON April 22, 1922, a meeting was held of representatives of 18 national biological organizations to consider the advisability of forming a federation,[1] and a year later, on April 26, 1923, the Union of American Biological Societies was formally inaugurated by the organization of a Council composed of accredited representatives of 15 member societies.

At the 1922 meeting, a publication committee of four was appointed to function jointly with a similar committee of the Division of Biology and Agriculture of the National Research Council. This committee presented a report to the Council of the Union at the latter's organization meeting, April 26, 1923. The report was adopted and the Council of the Union took the following actions:

(1) The Council of the Union of American Biological Societies considers that a single comprehensive system of biological abstracts is urgently needed.

(2) That the present Publications Committee be continued and given power to add to its membership subject to the approval of the Executive Committee of the Union of American Biological Societies and of the Executive Committee of the Division of Biology and Agriculture of the National Research Council.

(3) That the Council empower the Publications Committee (a) to formulate detailed plans for putting into effect a comprehensive system of biological abstracts for presentation to the Executive Committee of the Council of the Union and to the Executive Committee of the Division of Biology and Agriculture of the National Research Council; (b) to cooperate with the National Research Council in the continuation of its efforts to gain support for publication, abstracting and bibliography.

[1] SCIENCE, 56, 184–185, 1922.

(4) That the Executive Committee of the Union be empowered to pass, jointly with the Executive Committee of the Division of Biology and Agriculture of the National Research Council, finally upon such plans presented by the Joint Publications Committee, it being understood that such plans do not involve other than voluntary financial commitments of societies or constituent members thereof.

(5) That the Publications Committee be authorized to determine the probable support from members of constituent societies for a comprehensive system of biological abstracts.

The substance of the Joint Publication Committee's report, with some additions, follows.

While the Joint Committee is one on publication and bibliography, the discussions which led up to its appointment centered about the need and desire for abstracting and indexing services. So, while recognizing the fundamental need for improved publication facilities, the committee has up to the present confined its attention largely to the problem of a comprehensive integrated system of biological abstracts.

It is considered unnecessary to present extended evidence of, or arguments for, the importance of adequate informational aids to the investigator and teacher. Very early, even when the output of scientific literature was an insignificant fraction of its present volume, the need for aids was felt, and bibliographies, either unclassified or classified only as to certain major subdivisions, were developed. As the situation grew more complex, more detailed aids were needed, and there evolved from the relatively simple bibliographies the more highly classified and indexed ones which have reached a high state of development, though in different ways, in such agencies as the Concilium Bibliographicum, International Catalogue of Scientific Literature, etc.

Then, in the second half, and especially in the closing quarter of the last century, with natural science largely emancipated from traditional restraints, scientific publication increased by leaps and bounds, and the impossibility of thorough search of the original sources, because of limited library facilities and insufficient time, necessitated still more detailed aids. So, especially in the last two or three decades of the last century, began the conspicuous development of abstracts. These abstracts furnished at the same time classified bibliographies and brief accounts of current work. But the modern, detailed, searching subject index was not at first a feature of the abstracting journal, at least not of the biological ones; this indexing represents a still later development. Literature aids have thus undergone an extensive evolution, and are destined to develop still further to meet future changing conditions and demands.

There has probably never before been a time when

interest in making scientific information ascertainable has been so general throughout the rank and file of scientific workers. In the past, the problem has been mainly the business of a few—bibliographic experts or occasional men of science fired with the vision of the great service to be rendered to research and teaching by better mechanical aids in the literature. The man of science has, therefore, in a very large measure felt himself remote from such enterprises, which in consequence have not enjoyed his full support and active participation. Large numbers of scientific workers have thought of literature aids as necessary but hardly requiring their attention or participation. The dignity to which their importance entitles them has frequently not been accorded bibliographic efforts.

But the increasingly difficult problem faced by scientists due to the bewildering increase in the amount of literature has brought a gradual realization, earlier in some groups than in others, that the subject is of such vital importance that it demands their general support and participation. Only within the past few years has this sense of responsibility quickened generally among American biologists. This awakening is not entirely spontaneous. In large measure we have been aroused by the sudden collapse or serious impairment, during and since the war, of some of the most important of the aids on which we have relied in the past. This has helped us to realize how indispensable these are, and also that their production is a gigantic task requiring and deserving our best talent and efforts. It has awakened us, too, to the fact that, having so long accepted, without perhaps proper appreciation, the fruits of the efforts of our European colleagues, we can not now shirk those responsibilities which, because of our present more fortunate situation, are clearly ours. Whatever the contributing causes, it is a fact that these have led, within the past five years, to the establishment of four agencies in America which endeavor to abstract and index a large part of the world's literature in their respective fields—Endocrinology and Abstracts of Bacteriology in 1917, Botanical Abstracts in 1918, and the International Medical and Surgical Survey in 1919.

The committee has attempted to study the problem in a more or less fundamental way, giving especial attention to the organization, scope, completeness and adequacy of existing agencies, in order to discover if possible the shortcomings and causes thereof of the present procedure, and thereby be able, perhaps, to suggest ways and means of improvement.

A survey has been made by the Committee of the agencies which attempt to make a serious contribution to biological bibliography of international or national scope. (A brief résumé of this survey is appended to the minutes of the meeting of the Council of the Union of American Biological Societies held April 26, 1923.) This survey includes between 75 and 100 agencies devoted wholly or in considerable part to bibliography (abstracts, indexes, bibliographies, etc.) in the biological sciences, excluding psychology and anthropology. In this number are included many of those medical agencies in which the fundamental preclinical sciences as well as clinical medicine are extensively represented.

Of this large list, one has attempted to cover the whole of biology, indeed the whole of science. Several seek to cover botany and zoology, respectively, in a comprehensive way. Others have such large objectives as medicine and agriculture. But the great majority have a very restricted scope, so restricted as in many cases to deprive the user of adequate contact with important related fields of biology which contribute to his specialty.

In the judgment of the committee, a fundamental weakness in the present procedure is the multiplicity of uncorrelated and inadequately supported agencies. The majority of these reviewing, listing, indexing and abstracting organs more or less efficiently serve special interests, and till the part of the biological field selected more or less imperfectly and incompletely with the result that the abstracting, indexing and listing in these departments is diffusely distributed, incompletely done, and often treated from restricted points of view. Inevitable, too, under this procedure is an appalling amount of duplication.

The effect of this dispersive movement in the bibliographical and abstracting field as a whole in biology has some features of immediate service—condensation of references, esprit de corps within the subject and its immediate clientele, etc. Upon biology as a whole and upon synthesis, common progress, and upon a wider diffusion of interest in other fields than that of the biologist's immediate endeavor this segregation is less helpful to the progress of biology on sound and broad lines. It is believed that a complete, well-edited and well-organized system of biological abstracts would contribute fundamentally in the way of suggestion, stimulus and widening point of view and greater precision in attack upon our common problems. Such a system, too, would avoid the unnatural segregation of plant and animal material in such unified subjects as genetics, evolution and cytology, and the unfortunate separation of much plant and animal physiology, pathology, ecology, etc., which still occurs in many of our largest services, because confining their efforts to the plant or to the animal field.

But quite apart from these considerations this dispersive tendency involves serious practical difficulties. The narrower the scope of a service, the more limited its support. The literature in many if not

all special fields is so widely diffused in scientific publications that it becomes quite impossible for the relatively weak special services to approximate completeness or adequacy. The meager support which such agencies can command means, too, that they are carried on very largely by personal enthusiasm and sacrifice with the uncertainties and discontinuity which this procedure is likely to involve.

In striking contrast to this more or less chaotic situation in biology, the committee has been impressed with the well-ordered procedure in chemistry, which in comparison is so splendidly served in America by one strong, well-supported system of abstracting and indexing.

The type of bibliographic aid preferred varies with the character of the work and training and habits of the individual biologist. Classified indexed bibliographies in book or card form and abstracts in book form are the chief more highly developed types now in use. The systematist especially prefers a highly classified arrangement, which has been achieved both in indexed bibliographies (*e.g.*, Zoological Record (book form) and Concilium Bibliographicum (card form) and in abstracting journals (*e.g.*, Just's Botanischer Jahresbericht). But the committee is convinced from its inquiries that the type of service which most nearly meets the needs and desires of the great majority of workers is the abstracting journal with detailed carefully prepared indexes. It is believed that by adding to the monthly abstracting journal the feature of annually cumulated, classified, bound volumes the service in general would be improved and the needs of those especially requiring a detailed classified or indexed arrangement met. Such an arrangement, too, would more nearly meet the needs of libraries, which in general express a preference for classified or indexed bibliographies. Since limited support has so greatly handicapped bibliographic undertakings in biology it is felt that any new developments should be so conceived as to merit and command the widest possible support.

The success and efficiency which characterize the plan of the American chemists in making the subject of chemistry a unit for purposes of abstracting and indexing and the further important fact that this plan has the uniform automatic support of members of the American Chemical Society, has encouraged the committee to secure the facts necessary for an approximate picture of the proportions and feasibility of a similar plan for biological literature under the auspices of the Union of American Biological Societies.

The committee has attempted to ascertain the approximate volume of the world's biological literature as measured by the annual number of titles. Its studies in this direction lead to the conclusion that the annual number of titles approximates 40,000. These calculations include the literature in the biological sciences, including plant and animal industry and paleontology, but excluding clinical medicine and psychology.

To check the committee's estimates, Mr. Gunnell, of the United States Regional Bureau of the International Catalogue of Scientific Literature, was asked to tabulate the annual number of titles in the various parts of the International Catalogue of Scientific Literature concerned with the biological sciences. Mr. Gunnell's total for 1913, the last year for which all parts of the catalogue appeared unaffected by the war, is 37,779.

The number of pages required to cover this literature (40,000 titles) in one abstracting journal on the basis that 6.8 titles could be cared for per page (the approximate average in *Botanical Abstracts* and *Abstracts of Bacteriology*) is approximately six thousand.[3]

Cost of manufacture and distribution of twelve monthly numbers totalling 6,000 pages plus 500 pages of index (estimated) in an edition of 7,000 (the committee has secured bids from ten or twelve printing establishments, on one of which this estimate is based)	$52,144.00
Estimated annual income from 1,000 institutional subscriptions at $15.00	15,000.00
Balance of manufacturing and distributing cost to be met by individual support	$37,144.00
Probable cost of manufacture and distribution to the individual should each of the 6,000 individuals who are members of the societies invited to adhere to the Union support a unified system[4]	$ 6.20

[3] The question of bulk of such a service having been raised, the possibility has been considered of issuing it in parts individually obtainable. The committee is of the opinion that breaking up the publication would introduce complications and uncertainties which might involve an increase in the cost to the individual and a weakening of the undertaking, should it be entered upon.

The policy of the American Chemists, now in successful operation for sixteen years, too, has impressed the committee with the desirability of keeping the service intact. The committee has, therefore, sought to meet the problem of size in another way, namely by searching for less bulky papers. Excellent papers are available which bulk less than one inch per thousand pages. Using such paper would reduce the linear shelf room, annually necessary for the volumes, to less than six inches, even should the journal report on approximately all the world's biological literature. For libraries and others desiring them, copies printed on heavier paper could be furnished.

[4] Since binding, probably in two volumes, would be necessary to make the journal thoroughly usable as a reference work, the subscriber would have an additional outlay of $4.00 or $5.00, or a total cost in the vicinity of $10.00 or $11.00.

Editorial overhead: These calculations do not include editorial, bibliographic and clerical overhead. The National Research Council is continuing its efforts to secure adequate support for international scientific bibliography and abstracting. If these efforts meet with further success such support may be expected, at least at the outset, largely to meet such overhead.

The above calculations are based on twelve monthly numbers annually, the abstracts classified in subject-matter sections with cross references, so that the material in a particular field can be consulted as conveniently as in a journal of more limited scope. In order, however, to provide a more highly classified instrument, especially for the systematist and others particularly served by such an arrangement, and also to bring all material for a given year and in a given category together, the committee has investigated the additional expense involved in cumulating the material at the end of the year and issuing it in one or more bound volumes, after which the monthly numbers, printed on less costly paper, can be discarded, used by the subscriber for making special bibliographies, or otherwise utilized. In the cumulated volume the material having appeared under a given section in the monthly numbers would be brought together and subjected to a more detailed classification than is practicable in the monthly issues—a classification as detailed as a careful consideration of the needs of the various groups may dictate. In addition to the more detailed classified cumulated arrangement, the annual volume or volumes would contain detailed alphabetical subject and author indexes, which have proved of such exceptional utility and supplement the classified arrangement in an important way, as instruments for locating desired information.

The committee is informed that the cumulated bound volumes would increase the estimated cost given above about 25 per cent., or a total for the monthly numbers and the annual cumulated volumes of $69,380.00.

Leaving the estimated annual income from 1,000 institutional subscribers the same, namely $15,000, the balance of $54,380 of the total manufacturing cost to be met by individual support, should each of the 6,000 individuals who are members of the societies invited to adhere to the Union support of a unified system, would be about $9.00 per individual. (This cost to the individual is well below that of the uncumulated journal bound by the subscriber; the large saving on wholesale binding more than offsets the added cost due to the cumulation.) It needs to be borne in mind that under a system of uniform support this sum would secure for the individual a monthly current abstracting journal and an annual classified and indexed master key to the world's biological literature, the latter bound in two volumes and fully ready for use without further expense of any kind.

The exigencies of the case require that the financial responsibility for such an enterprise be assumed initially largely by the workers in America, an obligation which can not well be shirked at this time, especially in view of the benefits which have for so long been reaped by American workers from the responsibilities carried in Europe. But assuming that there will be such assurances from American biologists as to make the venture financially possible, it is clear that the successful production of such a comprehensive service, *i.e.*, the prompt and adequate abstracting of approximately all the world's biological literature, presupposes the widest cooperation among biologists everywhere. In this cooperation the relation to the enterprise of all collaborating biologists would be the same, as now is the case in *Abstracts of Bacteriology, Botanical Abstracts,* and other services, European and American. If undertaken, the initial years of the service would constitute a trial period from which such readjustments, both as regards character of the journal and its direction, should come as experience and changed conditions may dictate. Indeed, this degree of plasticity should constantly characterize the service.

A. PARKER HITCHENS,
D. R. HOOKER,
C. A. KOFOID,
I. F. LEWIS,
Representing the Union of American Biological Societies.
E. D. BALL,
C. E. MCCLUNG,
J. R. SCHRAMM,
A. F. WOODS,
Representing the Division of Biology and Agriculture of the National Research Council.

THE INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

THE annual meeting of the Fourth International Congress of the Union of Pure and Applied Chemistry was held in Cambridge, England, on June 17, under the presidency of Sir William Pope, professor of chemistry of Cambridge University, and was attended by representatives from twenty-one countries, nearly four hundred members and guests being present at the annual banquet.

The meeting lasted four days and among the important decisions reached by the various committees were the following:

The Committee on the Reform of Nomenclature of

Inorganic Chemistry decided to constitute a permanent committee composed of the editors of the *Journal* of the Chemical Society, *Chemical Abstracts, Gazzetta Chimica Italiana, Helvetica Chimica Acta, Recueil des Travaux Chimiques des Pays-Bas,* and the *Bulletin* de la Société Chimique de France. Each country is to send its suggestions to these various publications which will be duly qualified to submit them for general discussion.

The writing of formulas of acids, bases and salts in each country should conform to the usual custom in any particular language, that is, in the countries of Anglo-Saxon languages one would write HCl, H_2SO_4, $BaCl_2$, Na_2SO_4, $Ba(OH)_2$, etc., whereas in the countries of Latin languages one would write ClH, SO^4H^2, SO^4Na^2, Cl^2Ba, $(HO)^2Ba$, but in the same language one should not write sometimes ClNa and sometimes NaCl, nor sometimes SO^4Na^2 and sometimes Na_2SO_4.

The word hydrate will be reserved for combinations containing H_2O like the hydrate of chlorine, Cl_2 n H_2O; the hydrate of sodium sulfate, Na_2SO_4, $10H_2O$; the word hydroxide will be reserved for chemical combinations containing OH; aluminum hydroxide, $Al(HO)_3$; barium hydroxide, $Ba(OH)_2$.

The Committee for the Reform of Nomenclature in Organic Chemistry decided to increase the permanent committee composed of the editors of the *Journal* of the Chemical Society, *Chemical Abstracts, Bulletin* de la Société Chimique de France, by adding the editors of the *Gazzetta Chimica Italiana,* of the *Helvetica Chimica Acta* and of the *Recueil des Travaux Chimiques des Pays-Bas.*

The Geneva nomenclature will be used as basis for new proposals.

The Committee on the Reform of the Nomenclature of Biological Chemistry adopted the following resolutions dealing with the most general names:

1. The name of a new compound of which the chemical constitution is known must be made up in accordance with rules of nomenclature of organic chemistry;
2. The word *glucid* will be used to designate the group of substances which comprises the simple reducing sugars and substances which give one or several of these sugars by hydrolysis;
3. The word *lipoid* will no longer be used;
4. The word *lipide* will designate the group of substances which comprises the fat bodies and esters which possess analogous properties (lecithines, phosphatines, etc.);
5. The word *protide* will designate the group of substances which comprises the natural amino acids and substances which by hydrolysis give one or more of these acids.

The Committee on Bibliography recommended:

That the bureaus of documentation unify as much as possible their methods of work in accordance with the principles adopted by the International Institute of Bibliography and the Subcommittee on Bibliography of the League of Nations;

That in view of the resolution of the Subcommittee on Bibliography of the League of Nations, the chemical publications send at least two copies and preferably five copies of their annual index to the "International Institute of Bibliography" in order that this institute be in a position to draw up the "Central Annual Bibliographical Index of Authors' Names";

That the general secretary of the union make every possible effort to persuade those publications which have not yet come to a decision to conform with the two following resolutions which were passed at the previous congress;

That all original papers in chemistry should bear the address of the author or that of the laboratory where the work was carried out;

That the journals give a résumé of their articles in one of the languages accepted by the editorial board of the "Annual Table of Constants," in such a form that it could be published in an abstract journal.

The Committee on Physico-Chemical Standards recommended:

That the Bureau of Physico-Chemical Standards investigate, through circular letters addressed to the directors of the research laboratories, what are the new physico-chemical standards; the preparation of which would be most urgent.

The Committee on Pure Products for Research, in answer to the question asked by the International Oceanographic Association of the Mediterranean, replied that pure sodium chloride may replace standard sea water for the volumetric determinations actually in use in oceanographic work.

The Committee on the Bibliography of Industrial and Technological Products recommended:

That the Bureau of Vegetable Raw Materials, which is actually working in France, be incorporated in the Bibliographic Bureau of Industrial and Technological Products and that the Musée de la Faculté de Pharmacie de Paris and the Laboratoire Central d'Etudes et d'Analyses des Produits Médicamenteux et Hygiéniques (Laboratoire de la Commission du Codex) be incorporated in the Central Office.

The name of these united bureaus shall be "Service de Documentation sur les Matières Premières et les Produits Industriels" (Bureau of Bibliography of Raw Materials and Industrial Products).

The Committee on the choice of a Thermochemical Standard took note of the decision reached by the Bureau of Standards, Washington, that the benzoic acid prepared by this bureau can not be obtained as standard substances for calorimetric determinations except for purely scientific purposes and that it be-

comes therefore necessary to employ for technical purposes, in the determination of heats of combustion of solid and liquid fuels, benzoic acid from other sources. The committee will eventually draw up specifications for the approval of samples of benzoic acid.

The adoption of the conversion factor 1 cal. 15° = 1.184 joules was also recommended.

The Committee on the Tables of Constants recommended the following changes regarding physico-chemical symbols:

Molecular rotation is to be defined by the relation

$$(M) = \frac{M \times (\alpha)}{100}$$

the employment of "ω" for the specific magnetic rotation and "Ω" for molecular magnetic rotation is recommended; the molecular magnetic rotation is to be defined by the relation

$$(\Omega) = \frac{M \times (\omega)}{15}$$

The committee further recommended:

That a subcommittee be appointed, composed of Professors Cohen, Findley, Marie and an American member to be designated by the National Research Council. This committee is to consider further changes and additions in physico-chemical symbols.

The Committee on the Study of Ceramic Products adopted the definition of the word "ceramic" and the classification of various products under that name as adopted by the American Ceramic Society.[1]

The Committee on Food Preservation requested:

That the subcommittee of five members, composed of Messrs. Alsberg, Bordas, Paterno, Pondal, Voerman, present at the next congress a general report on the bibliography which has been gathered up to the present and which could be assembled from now until then in regard to all matters relating to food legislation in the various countries;

Also that at the next congress the delegates of the various countries, taking into consideration the legislation in force at the time, present their conclusions of the effects of employing the following products as food preservatives: benzoic acid, boric acid, salicylic acid, sulfurous acid; sulfates and formaldehyde; for the purpose of undertaking a systematical and physiological investigation on the possibility of using chemical products in food preservation.

The Committee on Scientific and Industrial Ownership presented the following resolutions:

1. The committee, considering that in the Latin group, which is composed of countries granting patents without examination, the unification of legislation appears to be more capable of realization than in the others, invites these countries to begin a grouping as soon as possible with the idea of forming a Union of Uniform Legislation;

2. Considering that the original purpose toward which one must work should be to permit research workers to protect their discoveries and considering that on the other hand research workers can not carry out their researches in secret but must on the contrary be able to publish the results of their work as they are obtained;

The committee resolved:

That it is inadmissible that one should oppose to the holder of the applicant of a patent the results of his own work during a certain period of time after it has been published;

3. The committee declares that a purely scientific discovery should be legally protected;

4. A proper definition of this new legal right will be studied by the committee;

5. In order to secure the coordination of all efforts the president of the committee is appointed as a delegate to the Committee on Intellectual Cooperation of the League of Nations and to the International Chamber of Commerce to present and uphold the views of the committee.

The Committee on Industrial Hygiene requested the council of the International Union to give a prize for the best published essay on smokes, gases, fogs and noxious vapors to be met with in manufacturing; their elimination; the protection against their effects. The essays submitted should be general and descriptive in character, should include the latest progress in their particular subject and should be within the reach of the general reading public.

The committee also requested that the council of the union should establish a prize to be given to the inventor of an apparatus of recent construction for the suppression of smoke. In case no recent inventor could be found the prize should be given to that person who had done the greatest amount of work and obtained the best results on the problem of the suppression of smoke.

The committee planned to report at the next congress forms of apparatus intended to combat incipient intoxication from poisonous gases in factories and to gather a bibliography of legislation concerning industrial hygiene in various countries and analytical methods for the determination of hydrofluoric acid in smokes and vapors with special reference to superphosphate manufacture.

All these resolutions and recommendations were duly approved by the council and by the general assembly. The congress decided to meet in Copenhagen in 1924. Two new vice-presidents were elected, Professor Ernest Cohen (Netherlands) and Dr. Sakurai (Japan).

The congress decided in closing to create a committee to cooperate with those organizations which undertake to exchange students and professors be-

[1] Journal of the American Ceramic Society, Vol. III, 526 (1920).

tween the universities of the various countries with the idea of cooperating with these organizations and of bringing about such exchanges among professors of chemistry.

J. E. ZANETTI

SCIENTIFIC EVENTS

THE OPTICAL SOCIETY OF AMERICA

THE Eighth Annual Meeting of the Optical Society of America will be held at Cleveland, Ohio, Thursday, Friday and Saturday, October 25, 26 and 27. Hotel headquarters will be at the Hotel Cleveland. All sessions for the reading of papers will be held in Room 86, Physics Building, Case School of Applied Science, and are open to all persons interested in optics.

The address of the retiring president, Dr. Leonard T. Troland, will be on "The Optics of the Nervous System." Professor A. A. Michelson will read, by invitation, a paper on "The Limit of Accuracy in Optical Measurement," and Mr. Frederic Allen Whiting, director of the Cleveland Museum of Art, will address the Society on "The Optical Problems of an Art Museum." Mr. M. Luckiesh and Mr. A. H. Taylor, of the Nela Laboratory of Applied Science, will give a demonstration of new apparatus for the projection of mobile colored patterns. There will be a full program of contributed papers and committee reports, on general optics, vision, colorimetry, photometry, spectroscopy and instruments.

Arrangements are being made for visits to: The Nela Research Laboratories, The National Lamp Works, Warner and Swasey and The Cleveland Museum of Art.

The advance program containing abstracts of papers will be mailed to all members about October 5 or 10. In so far as the number of copies available may permit, it will also be mailed to others on request, addressed to the secretary, Irwin G. Priest, Bureau of Standards, Washington, D. C.

Since there are other large conventions in Cleveland at the same time, hotels are likely to be crowded, and members and others expecting to attend are advised to make their hotel reservations at once. Dr. W. E. Forsythe, Nela Research Laboratories, Nela Park, Cleveland, is chairman of the Local Committee on Arrangements for the meeting.

IRWIN G. PRIEST,
Secretary

EXPLORATION OF SAN JUAN COUNTY, UTAH

AN expedition sent out by the National Geographic Society, which has been assembling its personnel and equipment at Gallup, New Mexico, started on September 17 for a reconnaissance of the San Juan country of southeastern Utah, hitherto unexplored.

Leaving Gallup the party used automobiles, carrying its supply of gasoline in drums to Kayenta, Arizona, and then planned to travel on horseback across the Utah line into a land of knife edge canyons, bold buttes and green-topped mesas until the pack animals encounter impassable barriers. Then it will proceed on foot.

The expedition will attempt a preliminary survey of the region between the Colorado and San Juan rivers, much of it never traversed by white men, which constitutes one of the largest unexplored areas in the country. The area of observation lies within San Juan County, a county which is larger than the State of New Jersey.

Dr. Neil M. Judd, archeologist, of Washington, leader of the National Geographic Society expeditions which excavated and studied the pre-Columbian communal dwellings of Chaco Canyon, New Mexico, heads the Utah expedition. Accompanying Dr. Judd is Edwin L. Wisherd, a staff photographer of the society, and a party of assistants and guides.

Dr. Judd's primary attention, on his reconnaissance, will be to determine whether the cliff dwellings and skeletal remains, the traces of pottery, basketry and cliff inscriptions believed to abound will justify other larger expeditions of the society which shall include experts in every phase of scientific inquiry which the area warrants.

Evidence of the outskirts points to cave dwellers, as well as cliff dwellers in this territory, for early Indians seem to have found shelter in the egg-shaped and shell-smooth caves of the vari-colored rock.

The fantastic beauty of this rugged desert, with its red rock gashes, its ever-changing color, and gargoyle promontories offers exceptional photographic opportunities; and it is possible that an incidental result of the trip will be the finding of such other spectacles as the natural bridges and rocky spires which occur in contiguous areas.

A NEW WILD LIFE PRESERVE

THAT many of our handsomest and most desirable native plants are becoming increasingly scarcer has been a matter of observation for many years. In a number of localities such exquisite plants as rhododendron, arbutus, fringed gentian, lady's slipper and various species of wild lilies have become practically extinct due to cultivation, grazing, drainage, lumbering and the promiscuous picking of flowers. One of the remedies frequently suggested by plant conservationists is the establishment of wild-life sanctuaries or preserves in which the endangered species can grow without molestation.

The efforts of the conservationists seem to be bear-

ing fruit, since a number of such wild life preserves have been established during recent years. The latest addition to the ranks is the Herbert Davis Forestry Farm which was recently bequeathed to the people of Indiana by Martha F. Davis in accordance with the wishes of her husband, Dr. Lewis Nelson Davis, who died a few years ago. The farm, which comprises a total of 385 acres of fertile land located near Farmland, Randolph County, Indiana, contains a sixty-acre tract of virgin timberland. The will by which the property was deeded to the citizens of Indiana states that the wooded area must be "treated as a forest preserve to be an example of Indiana's native forest, preserving native trees and plants in their natural condition." The will further states that the forest land must be kept in such condition that it will "be a refuge for all song birds and other useful birds, especially quail." Since Purdue University is a state institution the farm, with its wild life preserve, has been placed in the keeping of the trustees of the university. According to the terms of the will Purdue University is vested with the responsibility to "keep from becoming extinct our fine native wild flowers, medicinal plants and trees."

The Davis preserve is a fine example of virgin Indiana forest that is probably little changed since the time of the early settlers. The dominant vegetation is a rich growth of magnificent white and black oaks with a sprinkling of hickory, ash, maple, elm and paw-paw. One majestic white oak towers over a hundred feet into the air and is supported by a sturdy base over twenty feet in circumference. The undergrowth contains such attractive species as the nodding trillium, flowering dogwood and wild geranium.

In keeping with the trust imposed upon them the authorities at Purdue University who are actively in charge of the project have formulated plans providing for the stocking of the woods with lady's slipper, fringed gentian, wild lilies and other desirable species that are worthy of protection. By this means it is hoped to preserve some of Indiana's endangered native plants for the pleasure and profit of future generations.

ALBERT A. HANSEN

PURDUE UNIVERSITY

PRIZES IN CHEMISTRY

As has already been noted, Mr. and Mrs. Francis P. Garvan, in memory of their daughter, Patricia, have established prizes and scholarships in chemistry under the auspices of the American Chemical Society. Mr. Garvan writes:

In order that the youth of our country may have an intelligent appreciation of the vital relation of the development of chemistry to our national defense, for the intensification and purification of industry and agriculture, and to the progress of medicine through the "Age of Chemistry" upon which we have entered, and in memory of our daughter, Patricia, Mrs. Garvan and I tender to you the sum of $10,000. Six thousand dollars is to be expended by you in offering to each state six prizes of $20 in gold to students in all secondary schools, public and private, for the six best essays evidencing an understanding of the importance of chemistry in our national life. The remaining $4,000 is to defray the expenses of the contest.

In addition, we place at your disposal among the successful contestants in all the several states the awarding of six four-year scholarships in chemistry or chemical engineering at Yale University or Vassar College. These scholarships will carry $500 a year and tuition. The choice of subjects, all rules and regulations governing the contests, the awarding of the prizes, scholarships, etc., are to be under your absolute control and direction.

On authorization of the council of the American Chemical Society, Edward C. Franklin, president, has named H. E. Howe chairman of the contest committee and W. D. Bancroft, Charles H. Herty and Alexander Williams, Jr., as the other members of the committee.

Essays must be submitted before April 1, 1924. Winners will be announced not later than July 1, 1924. Essays must not exceed 2,500 words, and must be on one of these subjects: "Relation of Chemistry to Health and Disease," "Relation of Chemistry to the Enrichment of Life," "Relation of Chemistry to Agriculture and Forestry," "Relation of Chemistry to National Defense," "Relation of Chemistry to the Development of the Industries and Resources of Your State."

SCIENTIFIC NOTES AND NEWS

THIS number of SCIENCE is the fifteen hundredth under the present editorship.

THE autumn meeting of the National Academy of Sciences will be held at Cornell University, Ithaca, N. Y., on November 12, 13 and 14.

DR. DAVID STARR JORDAN, chancellor emeritus of Stanford University, has been elected president of the Pacific Division of the American Association for the Advancement of Science.

DR. L. O. HOWARD, chief of the Bureau of Entomology, has been appointed president of the International Conservation Conference to be held at Honolulu in 1924 under the auspices of the Pan-Pacific Union.

ON the occasion of the Pasteur Centenary, the French Government conferred upon Dr. Simon Flexner, director of The Rockefeller Institute for Medical Research, the rank of commander of the legion of honor.

DR. ANDREW BALFOUR, for the past ten years

director-in-chief of the Wellcome Bureau of Scientific Research, London, resigns that position on October 31. He will be succeeded by Dr. C. M. Wenyon, who for the past nine years has been director of research in the Tropics at the Wellcome Bureau of Scientific Research.

PROFESSOR J. M. WILLARD, head of the Department of Mathematics at the Pennsylvania State College, has, after thirty years continuous service, sent in his resignation on account of ill health.

DR. EDWARD H. MARSH, Brooklyn, has been appointed secretary of the New York State Department of Health to succeed Curtis E. Lakeman. Dr. Marsh is assistant professor of preventive medicine at Long Island Hospital Medical College and lecturer on hygiene in the University and Bellevue Hospital Medical College.

E. H. DARBY, formerly of the Department of Chemistry, Union College, Schenectady, N. Y., is now head of the research department, Rome Wire Co., Rome, N. Y.

JOSEPH S. BATES, formerly manager of the research division of the Marcus Hook, Pa., plant of the National Aniline and Chemical Co., is now with the Textile Service Co., Philadelphia, Pa.

FRANK B. GORIN, formerly of the Chemical Warfare Service, who for the past year has been making a survey of the facilities of the American dye and chemical industries, has been appointed chief of the heavy chemicals section of the Chemical Division, Bureau of Foreign and Domestic Commerce.

RODERICK K. ROONEY, formerly assistant professor of chemistry at the New Jersey College of Pharmacy, Newark, N. J., is now connected with the research and development staff of Lehn and Fink, pharmaceutical chemists and manufacturers at Bloomfield, N. J.

RALF R. WOOLLEY, hydraulic engineer of the United States Geological Survey, will represent the Federal Power Commission in the development of the Flaming Gorge site on the Green River. Mr. Woolley last year surveyed the Flaming Gorge district of Utah for the Geological Survey.

DR. GRINNELL JONES, of the division of chemistry, Harvard University, has returned to Cambridge from Washington, where since July 1 he has been assisting the Chemical Division of the U. S. Tariff Commission.

DR. NICHOLAS KOPELOFF, bacteriologist, of the Psychiatric Institute, Ward's Island, New York City, has been granted a year's leave of absence to do research at the Pasteur Institute and visit the laboratories of the Continent.

DR. GEO. T. HARGITT, professor of zoology, Syracuse University, has been granted leave of absence during the current year, and will devote his attention to research at the Wistar Institute of Anatomy and Biology, Philadelphia.

PROFESSOR AND MRS. T. D. A. COCKERELL, of the University of Colorado, returning from Siberia, were on board the *Empress of Australia* in Yokohama harbor when the earthquake occurred. They were not injured. The *Empress of Australia* being disabled, they were transferred to the *President Jefferson*. The U. S. entomologists working on the Japanese beetle (Popillia) were not in Yokohama at the time of the earthquake. The Plant Quarantine Station was destroyed, but Dr. Kuwana was absent in Corea.

DR. A. S. HITCHCOCK, systematic agrostologist of the United States Department of Agriculture, Washington, D. C., passed through Quito recently on his way to Banos and regions around Cuenca, Ecuador. Dr. Hitchcock is making three collections—one for the Gray Herbarium, one for the New York Botanical Gardens, and one for the National Herbarium, Washington. After leaving Ecuador, he will continue collecting in Peru and Bolivia. He expects to return to the United States about the first of February, 1924.

PROFESSOR NIELS BOHR, of Copenhagen, attended the Liverpool meeting of the British Association and lectured on the new element, "Hafnium." He was accompanied by Dr. Hevesy and Dr. Coster, both of whom presented papers at Liverpool. Two other prominent Danish scientific men were present at the meeting: Professor Schmidt, who spoke on the results of the Dana expedition, which studied the wanderings of the eel, and Professor Jespersen, who lectured on English grammar. On leaving Liverpool Professor Bohr expected to go to Canada and the United States at the invitation of American universities.

THE Government of New South Wales has asked Professor A. F. Barker, head of the department of textile industries at Leeds University, to prolong his stay in Australia. Professor Barker went there at the invitation of the New South Wales Government to take part in the Pan-Pacific Science Congress.

MR. C. BARRINGTON BROWN has recently brought home and has presented to the Sedgwick Museum of Geology at Cambridge a collection of Tertiary and Carboniferous fossils from the Amotape Mountains, near Cabo Blanco, in northwest Peru. These fossils are being studied by Mr. H. D. Thomas and Mr. A. G. Brighton. Mr. Brown is shortly returning to Peru to continue geological work and to complete a study of an early Pleistocene whale-bed which he discovered last year.

LAUGE KOCH, the Danish polar explorer, who started in March, 1921, on an expedition to Greenland, expected to arrive home on September 26, having succeeded in completing the task of charting far north Greenland, which he commenced on the second Thule expedition in 1917.

THE widow of the late Surgeon General William C. Gorgas is collaborating with Burton J. Hendrick, author of "The Life and Letters of Walter H. Page," in preparing a biography of General Gorgas. It is hoped to be able to publish the biography during the coming year.

THE July issue of *Health News*, the monthly bulletin of the New York State Department of Health, is a memorial to Dr. Hermann M. Biggs, state health commissioner from 1914 until the time of his death. Among those who have contributed in recognition of the services of Dr. Biggs are: Drs. Matthias Nicoll, Jr., T. Mitchell Prudden, William H. Park, Simon Flexner, H. Homer Folks, Linsly R. Williams and L. Emmett Holt.

DR. CHARLES FREDERICK MILLSPAUGH, curator of the department of botany of the Field Museum, Chicago, and professor of botany at the University of Chicago and the Chicago Medical College, died on September 15, aged sixty-nine years.

PROFESSOR LEROY CADY, associate professor of horticulture in the University of Minnesota college of agriculture, died on September 12 in St. Paul. Professor Cady was taken ill at the Minnesota State Fair, where he was assistant superintendent of the horticultural display.

JOHN HOWARD ROWEN, associate professor of mechanical engineering at the University of Minnesota, a retired naval officer with the rank of commander, died at Minneapolis on September 10.

THE death is announced at Manderscheid, Germany, on August 23, of Major Ernest Francis Bashford, M.D., O.B.E., late director of the Imperial Cancer Research Fund and adviser in pathology to the British Army on the Rhine, at the age of fifty years.

THE third congress of Industrial Chemistry will open in Paris on October 22, at the Conservatoire National des Arts et Métiers under the presidency of M. Dior, minister of commerce.

TRANSFERENCE of the plant of the Oregon State Bureau of Mines and Geology has been made to the School of Mines of the Oregon Agricultural College. It will be stored to meet the emergency caused by failure of the state legislature to appropriate money to pay for maintenance for the biennium 1923–1924. The plant includes library, reports and equipment.

WE learn from the London *Times* that the work of erecting a suitable building to house the Imperial College of Tropical Agriculture at Trinidad is proceeding. The new two-story structure of ferro-concrete will be completed by October, 1924. The college is temporarily housed in a building at St. Augustine, where there are six commodious class-rooms. It is proposed to add four other class-rooms to meet the needs of the institution, as it has been decided to increase the staff of professors and their assistants. During the last session eleven students were being trained, two of these holding scholarships offered by the British Cotton-Growing Association. One of the latter has already been appointed to Nyasaland.

MRS. C. L. HUTCHINSON, president of the Illinois Chapter of the Wild Flower Preservation Society of America, writes that the following act passed by the last Illinois legislature is now in effect:

> Any person, firm or corporation who shall, within the State of Illinois, knowingly buy, sell, offer or expose for sale any blood root (Sanguinaria Canadensis), lady slipper (Cypripedium parviflorum, and Cypripedium hirsutum), columbine (Aquilegia Canadensis), trillium (Trillium grandiflorum, and Trillium sessile), lotus (Nelumbo Lutea) or gentian (Gentiana crinita and Gentiana Andrewsii), or any part thereof, dug, pulled up or gathered from any public or private land, unless in the case of private land the owner or person lawfully occupying such land gives his consent in writing thereto, shall be deemed guilty of misdemeanor, and shall be punished by a fine of not less than $10.00 nor more than $100.00 and costs.
>
> All prosecutions under this act shall be commenced within six months from the time such offense was committed and not afterwards.

THE Committee of British Ophthalmologists appointed to organize an International Congress in 1925 finds, with regret, that it is unable to do so in accordance with the conditions under which the British invitation was accepted by the Washington Ophthalmological Congress in 1922. At Washington it was decided that the next congress should be strictly international and that German should be one of the official languages. The committee has since been informed that the Société Française d'Ophthalmologie, the Société d'Ophthalmologie de Paris and the Société Belge d'Ophthalmologie have passed resolutions to the effect that they feel themselves unable to participate in a congress if Germans are invited. The committee is of opinion that to proceed with the congress in these circumstances would tend to perpetuate a schism in the ranks of ophthalmology and militate permanently against the progress of the science, which all desire to promote. The committee has, therefore, reluctantly decided to postpone the congress.

THE twenty-second Flemish Medical Congress was held at Antwerp on August 11 and 12. The following papers were read: The physiology of the heart, by Professor H. Zwaardemaker, of Utrecht; extracardial influences on the heart, by Professor E. de Somer and Dr. P. Maeyer of Ghent; intracardiac arrhythmia, by Dr. S. de Boer of Amsterdam; pharmacodynamics and clinical administration of cardiac drugs, by Dr. U. G. Bijlsma and Dr. M. J. Roessingh of Utrecht; radiology of the heart, by Dr. M. Peremans of Antwerp; heart disease in pediatrics, by Dr. J. Lebeer of Antwerp.

UNIVERSITY AND EDUCATIONAL NOTES

FORTY-FIVE square blocks of Berkeley's most beautiful homes on the campus of the University of California up the hill slopes, north and east, were devastated by the fire on September 17, which is said to be the worst experienced by any California city since the San Francisco disaster of 1906. The fire was one of a series of forest, brush and grass fires, fanned by strong north winds and fed by undergrowth baked to a tinder by the prolonged summer. Such fires raged in nearly every county in Northern California. The buildings of the university were not harmed though it seemed at one time as if they would be destroyed. The homes of more than half the faculty and seven fraternity and sorority houses were burned. A shift in the wind then turned the course of the flames back over the burned area and many threatened buildings were saved.

AT the University of Buffalo instruction in the sciences fundamental to dentistry will be given hereafter in the departments of anatomy, biochemistry, pathology, pharmacology and physiology of the School of Medicine. To care for these increased responsibilities in the department of anatomy, of which Professor Wayne J. Atwell is the head, the following additions to the staff have been made: Dr. Rufus R. Humphrey, formerly of Cornell University, associate; Walter F. Greene, of Yale University, associate, and Ernest B. Hanan, of the University of Missouri, instructor.

THE work of preparing future executives for the oil industry will be undertaken by New York University. The course will be under the direction of Professor Ernest R. Lilley and credits toward a university degree will be given.

PROFESSOR Z. P. METCALF, head of the department of entomology and zoology of the North Carolina State College, has been appointed director of instructional work in the school of agriculture.

WILLIAM A. NEWTON, B.S. (McGill), Ph.D. (California), has been appointed assistant professor of botany at Pomona College. George M. Turner, specialist in petroleum, will be next year visiting professor of chemistry.

ARTHUR LL. HUGHES, research professor of physics in Queen's University, Kingston, Canada, has been elected Wayman Crow professor of physics at Washington University, St. Louis, to succeed Professor Arthur H. Compton, who goes to the University of Chicago.

DISCUSSION AND CORRESPONDENCE

THE NEEDS OF GERMAN SCIENTIFIC MEN

IN connection with certain scientific work, it was incumbent on me to make a special trip to Germany this summer to confer personally with one of the most eminent and renowned scientists of that land, who was professor of physiology in a famous German university. I had never been to Germany before and had never had the privilege of meeting the distinguished man whom I was on my way to see. Indeed, we had little in common, because our primary interests were in different realms of science. As soon as he heard of my arrival in the little university town where he lived, he invited me and my son (who accompanied me on my journey) to have afternoon tea at his home, whither we repaired at the appointed hour. It was a charming old house which spoke everywhere of refinement and culture and comfort. The professor and his wife met us at the threshold and bade us welcome in the most hospitable manner. On the table at which we sat down there was a little black bread and one or two unappetizing dishes. My host apologized for the meagre repast, saying simply that nowadays they were reduced to great extremities for food. His wife added that they had had no butter or milk or eggs for months, but occasionally they contrived to get a little meat, usually horseflesh, and sometimes a bit of coarse fish. I asked many questions about the domestic situation, but they were reluctant to talk about it. A girl named Marta waited on the table. She had lived with them twenty-five years or more, and each week she came to her mistress and implored her to reduce her wages, although they were not enough to buy a postage stamp. Madame took me aside after tea and cautioned me not to converse with her husband about the present distracted state of affairs. Every penny they had saved in a lifetime was gone; they owned the house in which they lived, but could not afford to keep it in ordinary repair. Her husband could not bear to talk about the desperate situation. His only relief from day to day was to try to bury himself in his work and shut out the ever-present fear of impending disaster as

much as possible. Even this slender resource was not available except in a limited way, because he lacked the apparatus and facilities for carrying on his researches and was almost entirely without recent books and current periodical literature.

The professor conducted me to his study, and there we talked about the special matters connected with my mission. With as much tact as possible, I ventured to express some sympathy with him on account of the conditions under which he and his colleagues had to labor, and volunteered to send him a few books and scientific journals when I got home, at the same time suggesting that perhaps he might write me and advise me how I might be of service in other ways.

A few days ago I got a letter from him referring to various subjects about which we had conversed; one paragraph of it was devoted to the question of aiding German scholars, in compliance with my request. I think conditions have grown rapidly worse since the middle of July when I was in Germany; otherwise, I doubt whether the writer would have alluded to the subject at all. The following is a translation of this portion of the letter:

When you were here this summer, you intimated that among your friends in America there were perhaps some who might be glad to be of aid in some way to German science and its votaries. In this connection you asked me to advise you what was the best way to accomplish this. After mature consideration and consultation with several of my colleagues, I venture to write you as follows on this subject:

Concerning the general scientific situation and needs, such as repair of college, supply of literature, etc., the best method seems to be through the centralized bureau for this purpose established in Berlin (Notgemeinschaft deutscher Wissenschaft, Berlin C2, Schlossportal 3). If you wish to do something special, perhaps you should direct your attention to the domestic needs to which I have alluded already. While this situation affects all of us more or less, naturally it bears more heavily on some than on others. Thus, for example, here in our community a small society has been formed for several years, known as *Dozentenhilfe,* which is in charge of my colleague, Professor Blank, and which is intended to afford temporary relief in cases of extreme need, although it is very inadequate for the purpose. To keep this society going seems to me to be the most important thing to be done at present, because as things are now nobody can foresee what the next months have in store for us and whether far harder and more widespread ills are not impending over us than any we have heretofore learned to bear. With the sudden depreciation of our currency, it is hardly necessary to say that checks and drafts should not be made payable in German marks.

Obviously, for many reasons it would be better to send actual articles of value, especially such necessary things as are needful for a rational and desirable life; because our condition is rapidly nearing the typical starvation stage (*da unsere Zustände sich rapide der typischer Hungersnot nähern*). The number of those things which have disappeared entirely from the market and which are no longer to be had for any money is continually increasing. However, help of this kind is so complicated and difficult to compass that it can not be done effectively on any large scale, after the organization already created for that purpose has ceased to exist.

With warm greetings to you and your son, in which my wife joins, I am, etc.

As the writer did not authorize me to publish his letter, I have felt constrained to suppress the name of his colleague, Professor Blank, and also of the university where the "Dozentenhilfe" is established; but I shall gladly supply this information to any individual who will apply to me for it.

It does not seem necessary to add further comments, as the letter speaks for itself. Germany as a nation may, and doubtless will, recover; but for many individuals, who in some instances are among the most gifted and useful men and women of this time, there is no recovery. Their life and work is as good as ended.

JAMES P. C. SOUTHALL
DEPARTMENT OF PHYSICS,
COLUMBIA UNIVERSITY

FURTHER OBSERVATIONS ON THE SEX CHROMOSOMES OF MAMMALS

IN the following note the results of two studies dealing with the sex chromosomes of mammals will be given briefly.[1]

In insect spermatogenesis the sex chromosomes frequently persist during the growth period as densely staining chromatin-nucleoli. In mammalian spermatogenesis it has been generally assumed that the chromatin-nucleoli were of the same character, and a number of observers have sought to determine the type of sex chromosome from a study of these bodies. Very conflicting conclusions have been drawn from a study of the same material, however, and recently Gutherz has presented evidence to show that in the white mouse the chromatin-nucleolus forms an autosome.[2]

In the opossum the writer has followed the chromatin-nucleolus from the time of its first appearance until the telophase of the first maturation division. It forms the X-Y sex chromosomes of the opossum. During the growth period, however, the nucleolus is extremely labile in character and may assume a great variety of forms none of which give any hint as to the final shape which will be assumed in division. Unlike the insects, the X and Y elements of mammals

[1] These studies were carried on under a grant given by the Committee for Research on Sex Problems, National Research Council.

[2] Gutherz, 1923, *Arch. f. mikr. Anat.*

are very intimately associated during the whole growth period.

The sex chromosomes of an old world monkey has been studied in spermatogenesis and in the somatic cells of embryos. The Rhesus maccacus males show 48 chromosomes, one of which is a small ball-like element with no mate of like size or shape, just as the writer found in man and a new world monkey.[3] In the first maturation division there are 23 tetrads and one chromosome made up of two very unequal parts, the larger (X) being rod-like and the smaller (Y) dot-like. The X and Y components segregate to opposite poles of the spindle, just as they do in the case of man.

The somatic cells of male Rhesus embryos (amnion) show consistently 48 chromosomes, including the ball-like Y element and the rod-like X element, neither of which have mates of like size or shape. Female embryos (chorion and brain cells) show consistently 48 chromosomes, but no Y is present and the X is paired.

In the three primates studied so far by the writer (man, a new and an old world monkey) the sex chromosomes have all been of the X-Y type, which were very similar both in form and behavior. The evidence for the Rhesus monkey is complete and makes it certain that the sex chromosomes of the other two forms have been correctly identified.

THEOPHILUS S. PAINTER
UNIVERSITY OF TEXAS

SCORPIONS IN NORTH DAKOTA

IT is a well-known fact that scorpions are tropical in their distribution. The receipt in December, 1921, of three immature specimens, sent in by P. C. Arildson from Alexander, McKenzie County, North Dakota, near which point they were found in a lignite mine, was an occurrence of more than usual interest.

The appearance in certain newspapers of an account of the finding of scorpions in the state resulted in the receipt of several letters from persons in western North Dakota, who stated that scorpions had been seen several times previously. All these reports came from that general region known as the "Bad Lands."

Responding to my request for specimens a second instance was reported in the spring of 1922 and a single specimen was sent in from Oakdale, in Dunn County, North Dakota, with the statement that several had been seen near that place during the winter. A third instance of the kind was reported from Golden Valley County, when a single specimen was sent in from Trotters, North Dakota, in November, 1922. Both these localities are on the edge of the "Bad Lands."

All these specimens, except the last, have been referred to Dr. H. E. Ewing, U. S. National Museum at Washington. Dr. Ewing determined the scorpion as *Vejovis boreus* Gir., and wrote that the specimens sent were identical with others of this species from the old Marx collection in the museum, taken from Fort Pierre "Dakota" (South Dakota) years ago. According to Ewing (in litt.), "*Vejovis boreus* is represented in our collection by specimens from Lincoln, Nebraska; Indian Springs, Georgia; Gold Hill, Oregon; Soldier, Idaho; Fort Steele, Wyoming; Arizona; Salt Lake, Utah; and some other specimens with no locality."

Professor J. H. Comstock in his "Spider Book" records 23 species of known scorpions in North America. Of these only one, the species under consideration, is found at all in the northern United States. In the fourth provisional zone map of North America, published by the U. S. Biological Survey, small portions of western North Dakota are indicated as being included in the upper austral zone, the remainder of the state being in the transition zone. From the records at hand it seems likely that this species may belong to the upper austral. There seems to be no previous record in the literature of the occurrence of this order in North Dakota.

R. L. WEBSTER
NORTH DAKOTA AGRICULTURAL COLLEGE

[3] *Journ. Exp. Zool.*, Vol. 37, p. 291, 1923; SCIENCE, Vol. LVI, p. 286, September 8, 1922.

QUOTATIONS

THE PRIESTLEY MEDAL

THE first Priestley Medal of the American Chemical Society has been awarded to Dr. Ira Remsen, President Emeritus of Johns Hopkins University. His achievements in research have been principally within the field of pure science, his discovery of saccharin being little more than an incident among them. Of great importance have been his contributions to the linking of chemistry with medicine. Distinction is also his for his unwearying efforts—and success—in keeping the torch of chemistry alight in this country when the public either could not or would not see that there was illumination in the flame.

Returning from Germany in 1872, he became professor of chemistry at Williams College, where, after earnest pleading, he secured laboratory space eight by ten feet. But in 1876 Johns Hopkins invited him to go to Baltimore as professor, to do his own work in any way he pleased, assured that no one would interfere with him. His organization of the famous department of chemistry in that university has sometimes been referred to as the turning point in the science in the United States. In 1879 he brought out *The American Journal of Chemistry* and edited it

continuously until 1914. His text-book on organic chemistry has been translated into many languages and is in use in many countries.

Greater than any other phase of his work has been his inspiration of the men whom he trained. To the younger students he appeared cold, distant, severe—an impression emphasized by his faultless dress, precise speech, perfect manner and dignified bearing. Later, when they became more familiar with the working of his mind, they perceived that this precision in habit and speech and gesture was, as a former student put it, "the polish of chilled steel and not a coat of varnish on wood." As soon as a student proved his interest in his work and showed a proper comprehension of what it meant he found Professor Remsen richly gifted with the ability to arouse curiosity and enthusiasm. It was then that reverence and affection began to grow together. The erstwhile cold and distant professor would gladly take hours in discussing a student's plans of study with him and count the time well spent.

The Committee on Award has done well to provide that the first Priestley Medal shall go to so great a teacher, so eminent a man of science, and withal so distinguished a gentleman and scholar.—*The New York Times.*

SCIENTIFIC BOOKS

A Comprehensive Treatise on Inorganic and Theoretical Chemistry. By J. W. MELLOR. Vol. I, 1065 pp, H. O; Vol. II, 894 pp, F, Cl, Br, I, Li, Na, K, Rb, Cs; Vol. III, 927 pp, Cu, Ag, Au, Ca, Sr, Ba. New York, Longmans, Green & Company. Price $20.00 per volume.

THE appearance of the first three volumes of this important work which "aims at giving a complete description of all of the compounds known in Inorganic Chemistry, and, where possible, these are discussed in the light of the so-called Physical Chemistry," permits a somewhat better estimate to be made of the value of the series (to contain six or seven volumes when complete) than was possible when only the first volume was available.

So unique a work in English has naturally attracted much attention, as is attested by the numerous reviews of the separate volumes which have appeared in the technical, and even in the popular press.

The first impression is one of admiration and wonder at the courage and industry of the author in attempting so tremendous a task, and the scientific world, particularly the English-speaking world, must be very grateful to Dr. Mellor for this important contribution to chemical literature.

Most large reference books have been written by a number of authors under the editorship of an individual or group; the present work represents a distinct departure from that system. Certain faults are inherent to either method. It is very difficult to bring about unity of treatment, and to avoid overlapping, where different chapters are written by different individuals; on the other hand, in the work of a single author it is almost inevitable that the treatise shall be somewhat colored by the individuality of the writer, and that emphasis shall be given to particular phases of the science in which he may be most interested. It can not be said that the "Comprehensive Treatise" has escaped entirely these latter faults, and they will seem more or less serious according to the individual who uses the book, and the purpose for which it is employed.

The method of treatment departs widely from the usual, the subject matter following almost the identical arrangement employed in the author's earlier text-book, "Modern Inorganic Chemistry," which the author declares in his preface to be an abridgment of the present work. The reviewer has already[1] expressed the opinion that this method of treatment is not a happy one. The elementary text-book, assuming little previous information on the part of the student, must of necessity limit its statements of theory to terms which may be understood by the student at that particular point in his development. This necessitates frequent incomplete treatment, which it is expected will be developed further at a later period. The same method in an advanced reference book leads to obvious disadvantages, for it means that the theoretical treatment will be subdivided and scattered. The first volume particularly of the "Treatise" illustrates this fault, for while entitled "Hydrogen and Oxygen," it really contains a large proportion of general historical and theoretical subject matter. As a characteristic example may be cited the section on "Valency," which gives a rather full discussion of the subject, but does not touch at all on the modern theory with its relation to atomic structure, as this subject is to be treated in a later volume. Similarly "Acids, Bases and Salts" are treated in the chapter on "Oxygen," but since the theory of electrolytic dissociation has not been introduced at this point, the subject is not discussed from this standpoint. "Equilibrium" is treated partially in Volume I but we find it somewhat amplified in Volume II under "Compounds of the Halogene with Hydrogen." "Colloids" are discussed under "Gold" in Volume III, but whether further attention will be paid to them will not be known until later volumes appear.

Numerous other examples may be cited, but these

[1] J. Am. Chem. Soc., 44, 1836 (1922).

may serve to illustrate what seems to the reviewer a serious fault in the treatment of theory, making it frequently incomplete, scattered and difficult to find.

The statistical information is much more satisfactory. An enormous amount of information is given, much of which is not available in any other reference book with which the reviewer is familiar. The historical method of treatment is employed, and an unusual amount of the older data is introduced. This may sometimes lead to a little confusion, as it is frequently followed by conflicting subsequent data, without comment by the author.

The references seem extremely full. They are given at the end of each minor subdivision, and may prove difficult to use unless a complete author index is to be included eventually. Many subjects are brought quite up to date; in others ten or twenty years may have elapsed since the latest reference quoted.

The style is that associated with the author's previous works—vigorous, entertaining, and interwoven with philosophy and humor, making the treatise unusually "readable" for a work of its type. In fact, it may be that it fulfills the purpose of providing outside reading for the advanced student better than most other purposes for which such a work may be used. Errors and misprints seem rare; rather curiously most of the errors which the reviewer has detected occur in the form of statements which say exactly the opposite of the author's intention. The book is very well printed and attractively designed. In the text words of particular importance are printed in heavy type, which aids the eye in locating particular subjects on the page.

The three separate volumes may be discussed briefly.

Volume I is somewhat introductory in nature, containing several historical chapters, together with such subjects as "The Physical Properties of Gases," "Solutions," "Crystals," "Thermodynamics and Thermochemistry," as well as the chapters devoted to "Hydrogen," "Oxygen" and their compounds. The volume is most satisfactory, in the opinion of the reviewer, in the purely historical chapters, and in the excellent chapters on "Ozone" and "Hydrogen Peroxide."

Volume II treats the halogens as a group, with comparison and contrast of their properties and those of their compounds, over four hundred pages being devoted to them. As an example of the large number of references it may be noted that seven pages of references in fine print follow forty pages of text on the subject of "Metallic Halogenates." The alkali metals (including ammonium compounds) are given treatment similar to the halogens.

Volume III treats "Copper," "Silver," and "Gold," separately and in much detail, while the alkaline earths are treated as a group.

Volumes II and III contain, naturally, a much larger proportion of statistical information than is the case with Volume I. They are therefore less subject to the criticisms indicated above, and seem to the reviewer more satisfactory for reference purposes.

On the whole the "Comprehensive Treatise" undoubtedly represents a most important contribution to chemical literature, and one that will prove invaluable to the investigator as a source of information and suggestion, and to the advanced student and teacher as a source of "outside reading" which will prove interesting and valuable.

The remaining volumes of the series will be awaited with much interest.

GRAHAM EDGAR
THE UNIVERSITY OF VIRGINIA

SPECIAL ARTICLES

A NEW OCCURRENCE OF THE BLACK-EYED YELLOW MUTATION IN RATS

IN 1914 a strain of black rats was developed in the animal colony of the Wistar Institute from several black individuals obtained in the F_2 generation of a cross between a wild Norway male and an albino female. The strain has been maintained through some 25 generations in which many hundreds of rats have been reared that have always bred true to type.

On January 14th, 1922, a litter of eight young was cast by a young black female that had been mated to a male taken at random from the black stock; all of these young later developed into seemingly pure blacks. Three days after the birth of this litter a ninth individual, apparently less than 24 hours old, was found in the nest. This individual, a female, was about to be discarded when it was discovered that the eye were a much lighter color than those of normal black rats at birth. It was reared by an albino female, and developed into a light grayish colored rat with dark red eyes. A color variety of this kind had never been seen in the colony.

When mature, this mutant female was mated with a "dilute gray" male.[1] The offspring of this mating, three males and two females, were all of the wild gray type, indicating that the new mutation was not one of the color-albino series of allelomorphs like dilution. When these grays were inbred they produced, among other color varieties, black-eyed yellow young. Yellow varieties of rats had previously been obtained only from the stock originally imported from England by Dr. Castle in 1914. As the Wistar colony

[1] P. H. Whiting and Helen Dean King, "Ruby-eyed dilute gray, a third allelomorph in the albino series of the rat," *Jour. Exper. Zool.*, vol. 26, 1918.

contained none of these rats, Dr. Castle kindly sent several for breeding tests.

A mating of the mutant female with one of Dr. Castle's pink-eyed yellow males gave young of the wild gray type; with a black-eyed yellow male the offspring were all black-eyed yellows. The types of young produced in the F_2 generation of these crosses proved conclusively that the mutant female was a "cream" or non-agouti form of the black-eyed yellow rat. The formula for the mutant is aarr, when A is the agouti and R the normal dominant color factor in black-eyed yellow.

The parents of the mutant produced a total of six litters containing 57 young, of which five individuals, two males and three females, were creams; 14 creams was the number to be expected. The mother of the mutant when mated with another male from the black stock cast only black young.

The sire of the mutant was mated with three other females taken at random from the black stock. Two of these females produced a total of 76 young, among which there were thirteen male and six female creams; the other female cast 30 young that were all black. This male was later mated with three of his black daughters: two cast only black young; the other produced six male and seven creams in a total of 34 young. The four females that produced creams among their offspring cast a total of 167 young, among which there were only 37 creams, although one fourth of the number, or 42 creams, were to be expected.

Several matings were made between black sibs of the mutants, but only black young were obtained. No other matings in the black strain have, as yet, given any of the creams.

The black sire of these mutants was born in July, 1921. When taken for breeding he appeared to be pure black, but as he grew older marked color changes appeared in his coat. Patches of hair on the sides of the body became ticked, like the hair of wild Norways, and on the posterior part of the back the hair was dark brown; around the head the hair remained black. None of the females that cast cream young showed any pronounced changes in coat color. The male developed pneumonia early in 1923 and would no longer breed. An autopsy showed that one testis was atrophied; the other appeared normal and will be examined cytologically by Dr. Ezra Allen.

The appearance of cream young among the offspring of black parents indicates that both parents must have been heterozygous for the cream factor, otherwise cream, being recessive to black, would not have appeared in the offspring. When and how the mutant factor originated can only be a matter of conjecture. It may have existed in the germ cells of the wild Norway male from which the black strain was derived, and failed to affect the coat color of any of the offspring because matings were not made between individuals heterozygous for this factor. This supposition seems untenable, since the strain was closely inbred and a large number of individuals reared. It seems more probable that the cream factor appeared in the germ cells of a black rat only two or three generations back, and that the chance mating of heterozygous individuals brought out the mutant form.

HELEN DEAN KING

THE WISTAR INSTITUTE OF ANATOMY AND BIOLOGY

THE OHIO ACADEMY OF SCIENCE

THE thirty-third annual meeting of the Ohio Academy of Science was held at Oberlin College, Oberlin, March 30 and 31, 1923, under the presidency of Professor Albert P. Weiss, of Ohio State University. Fifty-five members were registered as in attendance.

Dr. T. C. Mendenhall presented an appreciative memoir of Emerson McMillin, of New York City, whose death at the age of seventy-eight occurred on May 31, 1922. A member since 1892, and elected to fellowship in 1920, Mr. McMillin was always intensely interested in the work of the academy, although, so far as is known, he was never able to attend a meeting. Although he was personally unknown to the great majority of the present members, his generous contributions to the research fund, continued through a quarter of a century, have been a constant stimulus to the research spirit of the academy and the research work of its membership. Dr. Mendenhall's memoir appears in the May–June number of the *Ohio Journal of Science*.

Twenty-five new members were elected, and the following eight members were elected to fellowship: William Letchworth Bryant, Walter C. Kraatz, Paul Marshall Rea, Septimus Sisson, Warren N. Thayer, Roy Curtis Thomas, Lewis Hanford Tiffany, Edward L. Wickliff.

Officers for 1923–24 were elected as follows: *President,* K. F. Mather, Denison University; *vice-presidents—zoology,* W. M. Barrows, Ohio State University; *botany,* H. H. M. Bowman, Toledo University; *geology,* J. E. Carman, Ohio State University; *physics,* W. C. Devereaux, U. S. Weather Bureau, Cincinnati; *medical sciences,* B. M. Patten, Western Reserve University; *psychology,* H. A. Aikins, Western Reserve University; *secretary,* W. H. Alexander, U. S. Weather Bureau, Columbus; *treasurer,* A. E. Waller, Ohio State University.

The annual geological excursion, under the direction of the incoming vice-president for geology, Professor J. Ernest Carman, has been reported somewhat